

Prevalence, Risk Factors, and Effects of Performance-Related Medical Disorders (PRMD) among Tertiary-trained Jazz Pianists in Australia and the United States

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This study explores performance-related medical disorders (PRMD) among a sample of tertiary-trained jazz pianists. Participants included both Australian and US pianists ($n=214$), including current and former tertiary students, professional pianists, and teachers. This mixed methods (quantitative and qualitative) exploratory and descriptive study used survey and case studies to provide baseline data for further research. Students reported a past and present period prevalence of 63% for pain and 41% for PRMD (injury attributed to practice or performance) with the forearm being the body part most affected, usually by fatigue. Diagnosis and treatment were reported as often unsatisfactory mainly due to lack of knowledge of PRMD by teachers and by professional health providers, and also to limited access to specialist PRMD services where these exist. Although teacher knowledge of PRMD is quite low, students still seek advice primarily from their teachers. The current study highlights a need to address the issue of PRMD among jazz pianists and their teachers more strategically, both in its prevention and in diagnosis and treatment. *Med Probl Perform Art* 2014; 29(1):37–45.

The purpose of the current study was to research the prevalence and experience of performance-related medical disorders (PRMD) among tertiary-trained jazz piano students, former jazz piano tertiary students, professional jazz pianists, and their teachers. Although many articles have been published in the performing arts medicine field about the prevalence of PRMD among musicians and among classical pianists, there have been almost no studies specific to jazz musicians and jazz pianists published in the peer-reviewed journals on the topic of PRMD.

This study adds to a growing body of knowledge surrounding PRMD, focusing particularly on how it is experi-

enced by jazz pianists in Australia and the United States (USA). This research surveyed jazz pianists' practice/performance habits and techniques and their awareness of and experience with PRMD. It also examined the frequency, duration, and intensity of practice sessions and the demands placed upon jazz music students by their teachers and peers, and even the demands they place upon themselves. This study also explored the level of awareness and knowledge of PRMD among teachers of jazz piano students. Psychological issues (mental health including performance anxiety and depression), sight and hearing problems, as well as neurological disorders, such as focal dystonia, were excluded from the study.

The research arose from my personal concern as a jazz pianist, private teacher, and university lecturer, as I have observed the following performance conditions which I believe could lead to a breakdown in performance wellness among jazz pianists by contributing to the prevalence of PRMD among this group of performers:

1. There is a great deal of variation between instruments used in jazz work. Electric pianos and synthesizers are often required for performances, and slight changes to the set-up of the keyboard stand, keyboard stool, and music stand could be vital considerations. Some jazz clubs and other venues may have inferior quality pianos that have inconsistent and inefficient mechanical action and require extra effort to achieve the desired sound.

2. As a relatively new art form and even newer educational area, the jazz piano repertoire is perhaps less developed and there is no established tradition of repertoire which follows a recognised progression for the jazz piano student to follow through different levels of technical difficulty and work toward the more challenging technical material only when the stamina and physical strength have been properly developed.

3. Performing with drum set, amplified bass, trumpet, saxophone and trombone creates a need for the pianist to produce a larger than normal *forte* or *fortissimo* volume of sound

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Research was submitted to the UWA Ethics in Research Committee to ensure that the research complies with Human Research Ethics policies and procedures as established by the University in accordance with state and federal laws and accepted research practices.

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Author's note: The research is undertaken in line with the philosophical approach stated by Brandfonbrener in *American String Teacher* (1997), in which she stated: "Knowing not to expect earthshaking data will avoid disappointment in what may nevertheless be the slow systematic discovery of significant and useful information. The potential for these gains is excellent, and those musicians who are fortunate enough to benefit will be grateful for every bit of progress, no matter how insignificant it may seem at the time."^{1(p36)}

to compete with these louder instruments. The requirement to produce this added volume has inherent potential to place extra demands on the player's arms and fingers.

4. The stylistic traits of bebop, hard bop, and post-bop jazz generally incorporate a high degree of rapid repeated 8th, 8th note triplet, or 16th notes. The tempi are often above 200 beats per minute and the length of tunes can be considerably extended, thus making very specific demands in terms of repeated movements potentially leading to fatigue.

5. Jazz and Latin American music have been developing side by side since the 1950s. The Cuban musical influence on jazz is significant, and jazz pianists are often required to perform Cuban *montuno* patterns that are highly repetitive, played at the *forte* to *double forte* dynamic and often continue through the entire duration of the piece. Whether jazz piano repertoire indeed consists of more of this extremely repetitive and high volume type of music than other music forms is subject to discovery, but if so, it may eventuate in a higher prevalence of PRMD among jazz pianists.

6. Jazz jam sessions or cutting contests often encourage musicians to compete against one another to demonstrate their mastery of instrumental technique. In these situations, the immature player can easily be encouraged to perform beyond his or her level of physical development and thus potentially overload muscles and joints.

METHODS

Participant Sample

Purposeful (or selective) sampling of participants was necessary due to the small numbers of potential participants accessible to the researcher. The research surveys and the case study interviews were conducted with participants who are: 1) jazz pianists who are currently studying or are graduates from tertiary jazz education courses; and 2) teachers of jazz pianists. Participants from Australia and the USA were selected to give a wider perspective to the data. The initial analysis of a cohort of students and teachers in Australia was expanded to include a cohort of students from the USA following a field trip to eight universities and colleges offering jazz programmes in the USA. Other countries besides USA were not included owing to limited resources available to allow direct access to participants.

Participants for the survey comprised 160 students—106 Australia (52 male, 54 female) and 54 USA (18 male, 36 female)—and 54 teachers—36 Australia (25 male, 11 female) and 18 USA (11 male, 7 female). Case studies involved 3 students—2 Australia (male) and 1 USA (male)—and 3 teachers—2 Australia (1 male, 1 female) and 1 USA (male).

Research Design

This mixed method (both qualitative and quantitative) exploratory and descriptive study used the twin methodologies of survey (through questionnaire) and case study (through in-depth and open-ended recorded and transcribed telephone interviews) to gather data from both stu-

dent jazz pianists and their teachers about their perceptions of and experiences with PRMD. The questionnaire allowed for quantitative data collection, while the case study methodology offered a richer source of qualitative data. This methodology permitted a form of triangulation to verify or disconfirm, through a varied approach, the themes emerging from the survey²⁻⁴ and to compare student and teacher views and experiences of PRMD.

Survey and Case Study Questionnaires

Section A of the *Student Questionnaire* established general information regarding some demographic and some personal details including the student's tendency to participate in aerobic exercise. Questions also sought information about the age at which the student first began to practice and perform at the piano and the number of years this practice and performance had been maintained.

Section B of the *Student Questionnaire* probed the frequency, duration, and intensity of the student's practice and performance schedule and the student's participation in other keyboard (computer and midi-keyboard) activities. This section also enquired about repertoire.

Section C of the *Student Questionnaire* covered such areas as away-from-the-keyboard practice, posture, experience of and attitude to playing through pain, and individual experience of PRMD, asking details of what constituted and who diagnosed and treated any symptoms of PRMD (whether health professional or alternate practitioners).

Questions were also asked about students' tendency to participate in warm-up and cool-down activities. Finally, this section asked about the external factors that might contribute to a student's extending the frequency, duration, and intensity of their practice sessions.^{5(p411)}

In the *Teacher Questionnaire*, Sections A to C of followed the *Student Questionnaire*, asking teachers to report on their students' experiences using innate and acquired knowledge and questioning of current students. Section D differed from the *Student Questionnaire* in that it asked teachers about their continuous professional development in learning new teaching strategies with regard to PRMD, invited them to take stock of their knowledge, skills, and abilities in the field of PRMD, and asked them about their willingness to undertake further professional development in the area.^{5(p432)}

The six *Case Study* participants, selected from the survey participants, were asked a series of questions^{5(p458)} chosen to elicit in-depth responses to topics covered in the questionnaires, also encouraging the introduction of other related topics.

Procedures

A small selection of colleagues and students were asked to respond to and comment on the initial questionnaires to test for validity. A survey utilising the two separate questionnaires, (1) for students and (2) for teachers, was con-

ducted by the researcher and colleagues in timetabled classes and seminars both in Australia and USA and also by email and internet invitation. The 6 case study participants were interviewed by telephone. Interviews were recorded and transcripts made.^{5(p373)}

Data were analysed using the SPSS version 17 statistical package (survey) (IBM SPSS, Armonk, NY) and QTR NVivo version 8 (case studies). The former facilitated descriptive statistics, the latter facilitated the sorting of responses into coded themes.

RESULTS AND DISCUSSION

PRMD Indicator

It was decided to use “symptoms of injury,” chosen from a list of symptoms provided in Questions 39-40 of the questionnaire, to denote “physical injury attributed to practice/performance” as the PRMD indicator. The symptoms were listed with checkboxes to be ticked and included chronic pain, aching spasms, weakness, fatigue, tenderness, swelling, inflammation, soreness, tingling, tightness, stiffness, rigidity, numbness, and tremors. Since no measure of pain was provided, although pain was reported in Question 36-38 by 97/160 (63.4%) participants, nonspecific pain was not considered a reliable enough indicator of PRMD, since pain could be seen, not as a PRMD, but as a symptom of a potential PRMD.

Data Analysis

When analysing data, (M)ANOVA (multiple analysis of variance) and *t*-test statistical analysis were ruled out since neither random sampling nor homogeneity of variance was achieved. There were also too many variables. Results are reported to make the most sense of the statistics gathered.

Out of a reporting group of 160 respondents, 54 reported suffering injury which they attributed to practice/performance (Questions 39 and 40). Although not all who reported injury due to practice also reported injury due to performance, all who reported performance injury also reported practice injury. Therefore both sets of results were merged and a further group of 12 participants who reported they did not suffer injury due to practice/performance (Question 39), but reported symptoms without considering them sufficiently severe to be classified as injuries (Q40), were also included. Therefore the total number of students claiming past or present injury due to practice/performance was 66/160, or 41.2%, rounded to 41%.

Survey Results

Prevalence and Anatomical Location of PRMD: The prevalence and location of PRMD reported by the jazz pianists, as well as the most common complaint, as reported in the questionnaire appear below. Figures exceed 100% because many students reported more than one symptom.

1. Forearm = 84.7% (most suffered fatigue, 20.2%)
2. Neck = 64.2% (most suffered soreness, 11.7%)
3. Shoulder = 44.0% (most suffered stiffness, 8.9%)
4. Hand = 35.1% (most suffered fatigue, 8%)
5. Triceps = 32.6% (most suffered fatigue, 7.5%)
6. Wrist = 30.7% (most suffered chronic pain, 7.5%)

These results suggest that the primary anatomical locations of PRMD in jazz pianists differ from those in the general population of keyboard players.⁶

The most common symptoms of PRMD reported by the jazz pianists, as well as the most common location, are reported below:

1. Fatigue = 60.9% (mostly in the forearm, 20.2%)
2. Soreness = 49.5% (mostly in the forearm, 16.8%)
3. Chronic pain = 49.2% (mostly in the neck, 8.0%)

The role of negative stress or “tension” was introduced into the study by teachers and students alike and remains unexplored, a suggested topic for future research. All descriptive results are presented with a degree of tentativeness and invite further study with improved methodology.

Playing through Pain: Of the 74 students who play through pain, 39 (52.7%) also reported injury.

Level of Continuing Disability over Time: Current findings are consistent with the work of Dawson,⁷ who found that only 4 of a group of 178 musicians, 75% of whom played strings and keyboard, failed to return to their previous level of playing after suffering PRMD. Schuele and Lederman⁸ reported similar results.

Age and PRMD: Almost half the students surveyed were in the 15–20 years age group (48.6%). There was a gradual decline in numbers with each age group (21–25 = 23.9%; 26–30 = 16.9%; 31–35 = 2.1%), until there was a small surge in those over 35 years of age (8.5%), accounted for by the number of mature-aged and postgraduate students in the group. The prevalence of PRMD peaked in the 26–30 years group (54.1%), followed closely by the 21–25 years age group (52.9%) (Fig. 1). Of the other groups, the 15–20 years age group reported slightly less (44.9%), and the 31–35 years age group less again (33.3%), while those over 35 reported the least of the cohort (4.5%). A higher PRMD rate among older tertiary students accords with other research.^{6(p413)} The lower rate of PRMD in the older age groups may be due to a dropout phenomenon coupled with a tendency (as we found with our case study participants) to develop coping skills, such as rest breaks, to enable them to continue their playing career whilst becoming increasingly aware of risk factors associated with PRMD.

Occupation and PRMD: Brandfonbrener, Amadio, and Kalish⁹ advise researchers to be aware of second career choices when evaluating the cause of participant PRMD. This advice may also extend to previous career choices. As one student commented: “My back and shoulder injury did not occur from playing music. It occurred from having worked at Woolworths and the lower back has been injured most of my life.”^{5(p354)}

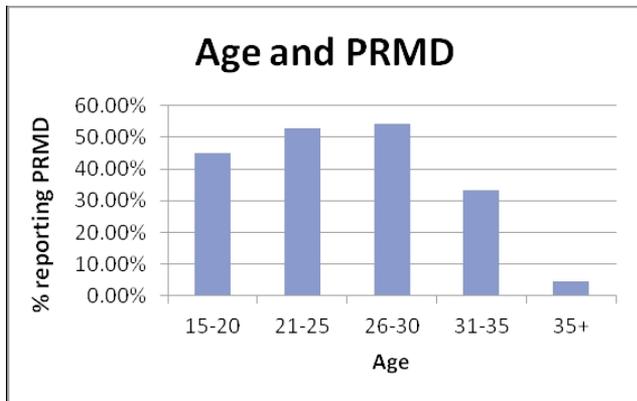


FIGURE 1. Age and prevalence of PRMD.

Aerobic Exercise and PRMD: Most students (60.4%) reported participating in some form of aerobic exercise in various forms, and the overall result indicated that those engaged in regular aerobic exercise reported a lower rate of PRMD.

Frequency, Duration and Intensity (Speed/Volume/Attack) and PRMD: Students were asked to report on their frequency of practising in what they considered was a normal week and a peak week. Students practised an average of 6.08 times per week for an average of 2.70 hrs/session, ranging from 2 to 24 hrs/wk, making an average of 15.99 hrs in a regular or normal week. In a peak week, however, students reported practising an average of 6.9 times per week for 3.19 hrs/session, for a range of 3 to 35 hrs, thus practising an average of 22.8 hrs in a peak week.

There was a marked increase in practice hours the day before the student's individual piano lesson. For the intensity of practice, the profile of the jazz piano student emerged as spending 42.1% of their practice/performance time at medium speed, 48.4% at medium volume, and 46.1% at medium attack. No question was included about rest breaks.

Manchester¹⁰ has recommended taking rest breaks known as "periodization." Those following this advice would be expected to lessen the possibility of reporting PRMD.

Two students commented about intensity of practice: "Sometimes with performance, the gigs are all in a row, i.e., weekend and so, the intensity of performance aspects are magnified,"^{5(p453)} and "Practice for performance and performance volume and attack vary."^{5(p453)}

In agreement with some¹¹⁻¹³ and contrary to the findings of others,¹⁴ no relationship was found between intensity of practice/performance and PRMD. This does not mean that no relationship exists. Since there is no clear empirical measurement of what each level of speed, volume, and attack comprises, the data collected relied on each participant's perception. In addition, asking participants to estimate percentage of time spent at each level

invites inaccuracy. The challenge for future research will be to overcome these methodological difficulties.

Repertoire and PRMD: Some students' comments on repertoire follow:

My work is currently in soul/funk with heavy playing including *glissandos* and strobos.

Unfortunately, most of the music I play demands a heavy touch. I am regularly straining/fatiguing my hands. Still, I monitor the level of fatigue and reduce my practice when necessary.

Heavy playing (occurs), due to repertoire demands of the genre I am currently playing in.

Heavy attack is because of the emphasis on soul/funk numbers currently in my repertoire.

Currently playing more soul/funk and *glissandos*/strobos than usual due to performance schedule.

A lot of heavy attack and playing due to funk and soul emphasis.^{5(p353)}

The subject of repertoire was one that dominated students' invited comments throughout both survey and case study. Students assumed a link between PRMD and repertoire, but no meaningful statistics emerged to support this. The relationship between repertoire and PRMD in jazz is a complex area to explore as it could be argued that since the predominant style for jazz pianists is improvisation, within the repertoire, each individual has the power to choose the density of notes, duration, volume, speed, and attack of improvised passages in their practice/performance schedule, thus offsetting the demands of previously mentioned demanding repertoire types. Further research may lead to greater enlightenment in this area.

Warm-up at the Piano and PRMD: Students reported warm-up at the rate of 68.7% before practice and 68.0% before performance. Those case study participants who were interviewed about warm-up and cool-down practices clearly indicated that it was very difficult to warm up before a performance, although most tried to do so, even if only tabletop exercises or a "tinkle" on the venue piano. Conceding that some students do cool down after practice sessions, case study participants dismissed the idea of cooling down after performance as impractical. Therefore, the statistics gathered on cool-down (30% after practice, 17.5% after performance) may reflect the social desirability factor of self-reporting rather than provide an accurate reflection of the true state of affairs. The topic of away-from-the-piano exercises, though explored in the study, is not reported here.

Posture and PRMD: When asked the percentage of time spent on posture correction during practice/performance, students reported that posture modification occurred more often during practice (82.7% of the time) than during performance (62.0% of the time). In the current study, 82.5% of students corrected their posture during practice/performance. Of these, 43.9% also reported PRMD symptoms. Of the 28.5% who do not correct their posture during prac-

tice/performance, only 28.5% reported symptoms of PRMD. This may reflect a relaxation and focus issue where students who are immersed in the music are less likely to be thinking specifically of posture, rather than suggest that conscious correction of posture may be a precursor to PRMD.

Experience with Health Professionals and PRMD: Of the cohort of 160 participants, 75 (47.0%) were diagnosed and treated by a health professional. Some teachers (14.8%) reported advising students about PRMD and recommending a health professional, while 11.1% reported working through the problem with a health professional. Despite the general dissatisfaction expressed by the group, students expressed highest satisfaction with physiotherapists (69.4% satisfied) and the greatest level of dissatisfaction was with general practitioners (73.9% dissatisfied). Occupational therapists and acupuncturists both shared a 20% satisfaction level in student experience.

When prompted to specify the reason for dissatisfaction with the diagnosis/treatment obtained, two students commented as follows: “Because the problem still occurs,”^{5(p354)} and “Still eliminating how pain is derived.”^{5(p354)}

Students consulted physiotherapists (38.8%) and general practitioners (30.6%), chiropractors (14.6%), occupational therapists and acupuncturists (6.7%), and surgeon specialists (2.6%). No students reported seeing a psychologist/counsellor. Diagnoses were: musculoskeletal 73.3%; nerve entrapment 4.0%; and overuse syndrome 22.7%.

Comments from the case study participants (paraphrased) follow:

- Muscle fatigue—no clear diagnosis. (S1)
- Not RSI or anything specific, just one CT scan. They couldn't really see ... [anything wrong]. (S3)
- Two different diagnoses from 2 different doctors at the same institute, neither satisfactory. (S5)^{5(p175)}

One participant (T4) named several well-known types of PRMDs to indicate general knowledge of the topic of diagnosis but no personal knowledge.

A general dissatisfaction with the diagnosis/treatment of PRMD was made clear by case study participants' remarks. Survey students recited similar experiences of a frustrating process of seeking help, despairing, and eventually resorting to self-help. This resonates with the findings of those proposing that often nonspecific medical terms are applied when the musician patient is vague when describing their symptoms, which leads to nonspecific diagnoses not fitted to a recognised disorder.^{15,16} For the health professional, this imprecision makes classification, and therefore treatment, difficult. Further case studies and medical research in the area, together with more specialised training, are recommended to ensure better management of PRMD among all types of health professionals. As Bragge et al.¹⁷ have stated, “Poor medical awareness of musicians' needs often result(s) in suboptimal management of PRMDs.” Students would greatly assist the health practitioner if

TABLE 1. Student and Teacher Perceptions of External Pressures as Risk Factors for PRMD

Students		Teachers	
Time pressure	2.8	Teacher pressure	2.5
Workload	3.2	Time pressure	2.7
Personal perfectionism	3.5	Personal perfectionism	2.7
Peer pressure	3.6	Peer pressure	3.6
Psychological stress	4.1	Workload	4.2
Teacher pressure	4.2	Psychological stress	4.4
Job insecurity	5.3	Job insecurity	5.0

they were also aware of anatomy and the nature of PRMD to better recognise and describe symptoms.^{18(p801)}

Alternative Therapies and PRMD: General exercise as an alternative therapy was reported by 50% of the group of participants as very successful. Meditation was found by 63% to be highly successful. The highest level of satisfaction was with Alexander technique (66% successful).

One student offered the following comment on the Alexander technique as an alternative therapy for the prevention/treatment of PRMD: “I'm eternally grateful to the ‘conservatorium’ 1985–88 (as a student) for providing a semester of one-on-one Alexander technique sessions which I believe has enabled me to perform mostly pain-free over the previous two decades. I would love to see a similar initiative for all students to access currently.”^{5(p354)}

Others also give support to this type of preventative therapy.^{6,19–21} A majority of student participants (65%) reported seeking treatment for PRMD through alternative therapies.

Since 47% have reported consulting a health professional in the previous section, these combined statistics imply student under-reporting of PRMD experiences (41%) in previous questions. Even if some students have accessed both avenues of therapy, the statistical anomaly may be indicative that there will always be a “culture of silence,”^{17(p71)} leading to nonreporting of PRMD among professionals who fear repercussions in a competitive profession.

Teacher Perception of External Pressure: Teachers were asked about external pressure factors and their role in contributing to PRMD and to attribute reasons for students to increase duration, frequency, and intensity of practice/performance. The mean ranking of the eight factors by both students and teachers is shown in Table 1.

Case Study data from at least one teacher seemed to confirm that many teachers assume they are the primary factor in motivating the student's schedule of extended practice. The fact that students place teacher pressure in sixth place out of seven, and teachers consider teacher pressure as first place, indicates a disparity between the actual motivation of students and teacher perception of such motivation. Since there are so many points of agreement, the wide variance between students' and teachers' perception of the role of teacher pressure merits further scrutiny.

TABLE 2. Summary of Attributed Causes of PRMD

1. Lack of awareness of PRMD
2. Bad posture
3. Lack of exercise
4. Carrying heavy gear
5. Lifestyle, being obsessed to achieve and not taking a holistic approach
6. Excessive keyboard use (practice time coupled with computer and digital keyboard use)
7. Playing mechanically and disconnected from the music
8. Too intense practice
9. Failure to warm-up
10. Muscular and emotional tension (term introduced by students and teachers) brought about by a failure to consciously relax
11. Technical flaws
12. Exam/assessment demands
13. Perception of the invulnerability of youth
14. Length of playing time
15. Personal perfectionism
16. Peer pressure
17. Secondary occupational hazards in the participant's other occupation(s)

Summary of All Causes of PRMD: A list of attributed causes of PRMD emerged from the student and teacher surveys and case study responses (Table 2). Although the importance of breaks (periodization) was overlooked and therefore unasked as a question in student, teacher, or case study questionnaires, the topic was brought up by some during the interview process. However, it was not proposed by either students or teachers as an attributed cause of PRMD. This lack of awareness may suggest a topic for further specific research.

Teacher Knowledge of Diagnosis/Treatment, Cause and Prevention of PRMD: Rogers²² pointed out the low level of awareness of PRMD among music teachers and the necessity for them to increase their level of awareness through further training with respect to piano-related injuries, so that they might be in a position to propose interventions where piano students may exhibit symptoms or predisposing factors to PRMD. Teacher knowledge areas queried in the current study included musculoskeletal anatomy, anatomy of the upper body, physical exercises for the upper body to improve muscle tone, biomechanical function for piano players, ergonomics, ergonomic posture, dorsi deviation of the wrist, flexor deviation of the wrist, hyperextension of the fingers, hyperabduction of the fingers, cognitive rehearsal (visual imagery of playing through the music), mental performance preparation, developmental stages of pianistic growth, developmental stages of physical growth, and developmental stages of musical growth.

The mean percentage of teachers self-reporting as most knowledgeable (in the areas listed above) rank as follows: 1) mental performance preparation (40.9%); 2) ergonomic posture (39.3%); and 3) biomechanical function for players

(38.1%) (percentages exceed 100% reflecting teacher response to more than one option).

The mean percentage of teachers self-reporting as having a vague idea (in the areas listed above) rank as follows: 1) cognitive rehearsal, i.e., visual imagery of playing through the music (62.8%); 2) physical exercises for the upper body to strengthen muscle tone (60.6%); 3a) hyperextension of the fingers; (52.4%); and 3b) hyperabduction of the fingers (52.4%).

The mean percentage of teachers self-reporting as having no knowledge at all (in the topic areas listed above) rank as follows: 1a) dorsi deviation of the wrist (42.4%); 1b) flexor deviation of the wrist (42.4%); 2) biomechanical function for piano players (31.8%); and 3) musculoskeletal anatomy (28.8%). Interestingly, a similar number of teachers reported knowing least and knowing most about biomechanical function for piano players.

Areas of least knowledge (obtained from the combined percentages of the lowest in “knowledgeable” and the highest in both “vague idea” and “no knowledge at all”) are as follows: i) dorsi and flexor deviation of the wrist (15.2% knowledgeable, 84.8% vague or no idea); ii) hyperextension and hyper abduction of the fingers (21.3% knowledgeable, 78.7% vague or no idea); followed by iii) musculoskeletal anatomy (22% knowledgeable, 78% vague or no idea).

For comparison purposes, Rardin²⁰ also nominated required knowledge areas for teaching PRMD.* The list presented in this study differs but follows the same general trend. These findings provide information to suggest content for any course that might be set up to inform teachers in the subject area of PRMD. The poignant response from one case study student underlines the important role of the teacher in providing support where PRMD is concerned: “The teacher I studied with in New York she really did a lot. Her and the one before ... who suffered injury himself. Some teachers seemed more sympathetic than others. Some were very sympathetic but simply didn't have anything practical to help me—nothing—nothing practical to help me with my problem.”^{5(p190)}

The importance of these data for the current study is to support the assertion that many, if not most, teachers have a low level of knowledge in many topics pertinent to the causes and prevention of PRMD.²⁸

Teacher Willingness to Gain Knowledge of PRMD: Wristen^{23,24} concluded that teachers have a responsibility to teach students self-awareness with regard to the risks of PRMD. Dawson²⁵ also emphasised the need for teachers to be willing to share with young musicians the potential risk of PRMD. The challenge may be for the conservatoriums

* From Rardin, a comparative list for teacher knowledge topics: (i) knowledge of risk factors; (ii) physical and musical warm-ups; (iii) frequent breaks; (iv) postural and spinal alignment; (v) economical movement; (vi) movement awareness; (vii) neutral joint positions; (viii) strong and flexible muscles; (ix) basic anatomy; (x) stretching; (xi) stress management; (xii) cognitive practice; and (xiii) kinaesthetic visualisation.²⁰

to equip teachers more adequately to meet the demands of students experiencing or wanting to avoid PRMD.

When asked if teachers who had reported “no idea at all,” in any subject area would be willing to learn about these subjects in the future, 32/54 (59.2%) answered yes, 9.8% answered no, and there was no response from 31.0% of the teachers.

Limitations to the Research

Some limitations of the research findings include the following points:

1. Several difficulties are inherent in self-reporting. The first is providing socially acceptable responses to questions, especially in classroom situations where one’s academic tutor or principal study teacher is the researcher. Despite assurances of confidentiality, participants may feel uncomfortable disclosing issues which may cause the researcher to view them in an unfavourable light. Therefore the participant’s need to be seen as socially desirable and compliant, as well as the tendency to exaggerate or downplay responses is a common methodological problem.

A second difficulty inherent in self-reporting is risk perception, leading to under- or over-reporting to avoid showing weakness in a very competitive field, which may lead to loss of status or loss of a place in a current course or perhaps a loss of future employment prospects in a small city. Despite assurances of anonymity, some doubt may remain in the mind of the participant about the content, handwriting, or other identifiable features making identification possible in their case. Paranoia is always possible in competitive fields of endeavour.

A third difficulty inherent in self-reporting is over-reporting in the sense of “I’m expected to tick as many boxes as possible or they wouldn’t be included.” A prime example of this was where no case study participants reported cooling down after a performance due to lack of facilities or opportunity, yet many survey students ticked the boxes or suggested specific post-performance cool-down exercises undertaken.

2. The inability to match the researcher’s and each participant’s interpretation of the levels of speed, volume, and attack threatens the construct validity of the questionnaire. In terms of reliability (that the results are reproducible over time using similar methodology) and validity (the instrument measures what it sets out to measure), the levels of speed, volume, and attack or estimated percentage of time spent on a particular activity may have been difficult to gauge so that high level attack, for example, may mean different things to different people and estimates may vary.

3. The inability to discover response rates due to delivering questionnaires generously among colleagues, friends, and associates, with an invitation to email these on to other interested people may have contributed to sampling error.

4. There is the likelihood that only those with an interest in PRMD may have responded in the seminar-based questionnaire administrative process. However, those in

timetabled classes were more of a captive group, but may have under- or over-reported for the reasons stated.

5. The absence of random sampling and homogeneity of variance precluded some statistical analysis, such as (M)ANOVA or *t*-testing. Also, the large spread of results meant that average results were not meaningful, and the extreme number of variables was too many for SPSS to process within and between groups comparatively;

6. Some difficulties are inherent in telephone interviewing. Whilst efficient and cost-effective for researcher and participant, it does remove the possibility of reading nonverbal signals. These latter can often provide insight into the nature of responses and the interviewee’s commitment to particular viewpoints.

7. There are differing perceptions of what constitutes pain, what constitutes injury, and how much a participant factors pain as an inevitable part of the practice/performance experience before registering it as “injury.” This is subjective information and unable to be calibrated;

8. Further limitations include some flawed questions in the questionnaire. For example, there may have been some misunderstanding of the term *aerobic* when asking about exercise patterns. The word *injury* also caused some difficulty, as some claimed no injury but went on to describe symptoms, presumably because in their view it is possible to have some symptoms that do not necessarily denote injury. Also the meaning of “posture correction” was not clear.

9. Asking respondents to estimate percentages of time spent in various activities may have made accurate answering difficult. Results are reported, but only tentatively, due to the difficulty in claiming that responses were uniformly accurate.

10. The inclusion of a disproportionate number of Western Australian students, many of whom were currently being taught by the researcher, may have led to a skewing of the student results.

11. The extreme length of the questionnaire may have caused many to fail to answer the final questions, or more frequently, skip through some of the intermediate questions and come back to the final ones.

12. The research does not achieve the ideal set out by Bejjani et al. to conduct research in a “true blinded, random case-controlled fashion.”²⁶

13. Any claims between any of the variables examined and PRMD remain necessarily cautious. As stated by Wu,²⁷ there are methodological problems involved so that, unless we thoroughly examine other activities in which those experiencing PRMD are engaged, we cannot make strong claims with respect to correlations between practice and performance activities and PRMD. For example, a pianist claiming elbow problems attributed to piano practice/performance may be an avid tennis player, a sport so notorious for the strain it imposes on the elbow that the term “tennis elbow” has been adopted into common terminology. “Golf thumb” could fall into the same category.

However, although the responses obtained from jazz piano students at tertiary institutions and tertiary-trained

jazz piano teachers may not meet with all the criteria of the most methodologically sound report, it is proposed that because of case study confirmation, most of the data collected can be cautiously generalised to jazz pianists worldwide until further research shows otherwise. Overall, there seems to be enough of a representative response from the jazz piano students and teachers involved in the research, and confirmed by triangulation of the data, to justify the tentative conclusions drawn from the research.

SUMMARY AND CONCLUSION

Although many articles have been published in the performing arts medicine field about the prevalence of PRMD among musicians and classical pianists, there have been almost no studies specific to jazz musicians and jazz pianists published in the peer-reviewed journals on this topic. This study set out to discover how PRMD affect or impact on the performance wellness of jazz pianists with tertiary education experience in Australia and the USA. The initial analysis of a cohort of students and teachers in Australia was expanded to include a cohort of students from the USA following a field trip to eight universities and colleges offering jazz programmes.

Performing arts medical centres and clinics, which are research based and supported by tertiary institutions, are becoming more common in the USA, as in Europe, and provide a model which could also work well in Australia. In the current study, it was found that there is a similar if not higher prevalence of PRMD among jazz pianists (63% pain and suffering and 41% PRMD, with 47% of 160 participants reporting attending a health professional for diagnosis and treatment) compared to other categories of musicians including classical pianists.²⁸ In this study, the forearm was identified as being the body part most affected, usually experiencing fatigue. Students of tertiary age, those between 21-30 years, have the highest prevalence of PRMD, while the over 35 and then the 15-20 year olds have the lowest rate. Some students commented about injury associated with repertoire demands.

Limitations of the study allow only tentative claims and there is a great deal of research yet to be carried out in the jazz piano sector. Students described nonspecific symptoms leading to diagnostic problems with no long-term disability in any cases studied. Physiotherapy was reported as the most recommended, utilised, and effective traditional preventative/treatment method, with Alexander technique, meditation, and general exercise reported as the most effective alternative prevention/treatment methods. Diagnosis and treatment of PRMD was generally regarded by students and some teachers as unsatisfactory, and this study reports on frustrated case study students who have given up on health professionals, sought alternative therapies, and/or resorted to self-help.

The expectations of jazz piano teachers regarding the musical and technical development of their students was mostly, in my opinion as a past student and current

teacher/performer, realistic and informed, with very few instances of unrealistic expectations such as demanding excessive practice or long practice sessions. What did emerge was how teachers underestimate the intrinsic motivation students have to respond to time pressures, workload, and personal perfectionism rather than teacher pressure.

In addition, many teachers did not show a conscious awareness of performance wellness issues, especially as they relate to PRMD, and reported they do not offer any classes in causes, effects, and prevention of injury related to musical practice and performance. Even though many express an interest in teaching these subjects in the future, others do not. Also, a high percentage of teachers responded that they do not know the appropriate health professional to whom they might refer their students or that PRMD is not their business. Student wellness and expectations suggest a need to make it every dedicated musician and teacher's business.

The current study highlights a need to address the issue of PRMD among jazz pianists more strategically, both in its prevention and in diagnosis and treatment. Alford and Szanto²⁹ over a decade ago (1996) made the point that until the causes and treatment of PRMD are clearly defined with a view to better recognition of cause and treatment, it will still remain a problem to be passed from one field to another for a proposed solution. They stated:

The medical world could blame pain on misuse; the virtuoso world on lack of genius or hard work; the pedagogical world on bad teaching or lack of talent. Unless one discipline or another takes responsibility for discovering the cause and treatment for PRMD in pianists, the whole topic may disappear into a no-man's-land for want of adequate attention.²⁹

The author can only endorse this position and would hope that collaboration among disciplines and a multiprofessional approach will be accepted future practice by all involved in the educational management of PRMD.^{5(p254)}

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